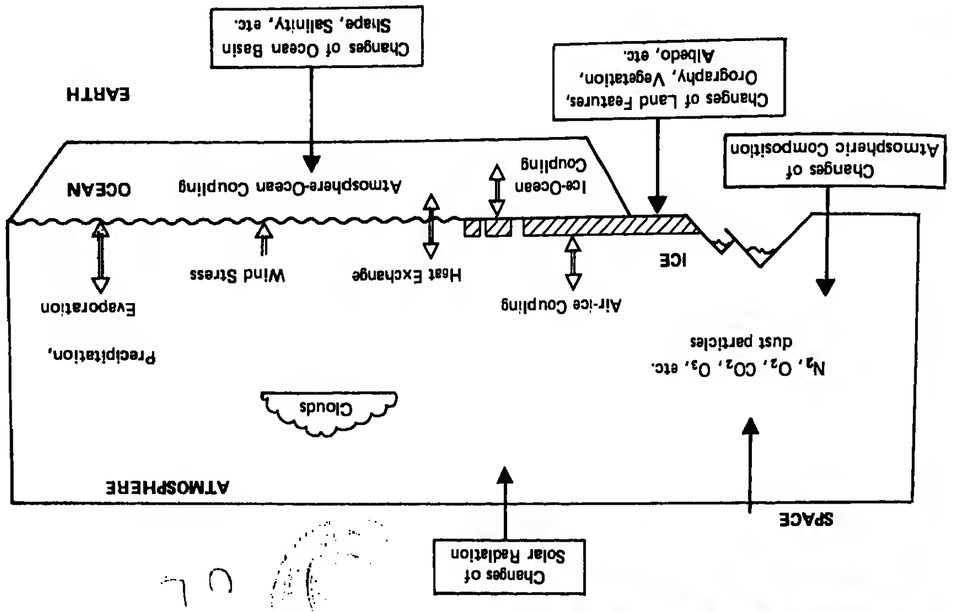

TRANSACTIONS, AMERICAN GEOPHYSICAL UNION
VOLUME 62 NUMBER 51 DECEMBER 22, 1981

Meetings

Precipitation Variations

How precipitation varies with space and time during individual storms will be discussed during an all-day symposium at the 1982 AGU Spring Meeting from May 31 to June 4, in Philadelphia, Pa. The symposium, sponsored by the Precipitation Committee of the Hydrology Section, will provide a forum for the presentation of recent research results on the formulas and area-depth-duration relations of rainfall. These describe the manner in which precipitation amounts vary, over the earth's surface and with time, in an individual rain cell, a single shower or thunderstorm, or a short rainstorm lasting much less than a day. The symposium will complement the AGU Chapman Conference on Rainfall Rates, to be held April 27–29 in Urbana, Ill.

Papers should emphasize practical applications to problems in runoff forecasting, drainage design, and rain-gauge networks, as well as storm dynamics. Abstracts, in standard AGU format, should be mailed to the symposium chairman, Jaime Amorocho, Department of Civil Engineering, University of California, Davis, CA 95616; deadline is February 15. In addition, the abstract original must be sent to Meetings, AGU, 2000 Florida Ave., N.W., Washington, D.C. 20009 by the Spring Meeting abstract deadline, March 10. Additional information can be obtained from Amorocho (telephone: 916-752-0685) or the associate chairman, David Hershfield, Hydrology Laboratory, SEA/AR, Beltsville, MD 20705 (telephone: 301-344-3941). ⊠

Shear Waves and Pattern Recognition

The third biennial SEG/USN Joint Technical Symposium will be held March 22–23 in Building 1200 of the National Space Technology Laboratories in Bay St. Louis, Miss. The symposium, sponsored by the Office of Naval Research and the Society of Exploration Geophysicists, will be hosted by the Naval Ocean Research and Development Activity (NORDA) and will be held in conjunction with NORDA's workshop entitled 'Pattern Analysis in the Marine Environment' (March 24–25).

The symposium's two themes are shear waves and pattern recognition in the marine environment. Among the topics to be discussed are detection and measurement techniques in marine and nonmarine environments; shear wave energy partitioning at transitional boundaries and effects on transmission/reflection losses in the marine environment; and shear wave data as an aid in defining seafloor engineering properties, depositional environments, lithologic variability, and elastic rock properties. Additional discussions will be held on pattern recognition, which is the automated detection, classification, and ordering of pseudo-random data. This data may be used for geologic and bathymetric charting and for structural and sedimentological analyses.

Prospective authors are requested to submit an abstract, a biographical sketch, and a statement of audiovisual requirements to J. Alan Ballard, Chairman, SEG/USN Technical Program, NORDA, NSTL Station, MS 39529 (telephone: 601-680-4760). Abstract deadline is January 6.

Participants should preregister with Myron Webb, Department of Conferences, University of Southern Mississippi, Long Beach, MS 39560 (telephone: 601-688-3054). The registration fee is $25. Lodging reservations should be made by March 10 through the Diamondhead reservations office (telephone 800-647-9550, 601-255-1421 in Mississippi). ⊠

Groundwater Conference

The 11th Rocky Mountain Groundwater conference will be held April 14–16, 1982, in Salt Lake City, Utah. Topics to be covered at the meeting include groundwater contamination, groundwater monitoring, and water well technology. In addition, a field trip to Salt Lake Valley is planned.

Send titles of proposed papers and requests for additional information to Joseph St. Gates, U.S. Geological Survey, W. R. D.; 1745 West 17th South St., Salt Lake City, UT 84104 (telephone: 801-524-5654). Deadline for papers is January 15. ⊠

News

Luxuriant Life on the Galápegos Seafloor

Marine life found unexpectedly in 1977 in the vicinity of hydrothermal vents along the Galápagos Rift has proven to be of considerable interest because of newly discovered growth mechanisms. Among the life forms observed were giant tube worms, clams, mussels, and plantlike animals. It the sizes alone were beyond belief, the hostility of the living environment—noxious, hydrogen sulfide-rich warm pockets—appeared bizarre. Even though life at depths of 2.5 km on the seafloor is known normally to be sparse in comparison with shallow-water biological systems, the heated water pockets seem to account for the localized contradictions. What was difficult to explain was the toxic environment and the apparent lack of nutrients. Furthermore, the tube worms had no mouths, not even digestive systems. Recent reports in *Science* (November 20, 1981), and by the Smithsonian Institution (Research Reports), describe findings on bivalves studied at the hydrothermal vents and tube worms returned to the laboratory by the U.S. Navy research submersible *Alvin*. The growth rates are among the highest known for deep-sea life. The way the deep seafloor marine life are understood to 'eat' (absorb nutrients would be a better description) involves mechanisms never observed before that breakdown hydrogen sulfide with bacteria.

The giant-size marine life along the Galápagos rift exist in pockets next to hydrothermal vents. Instead of the cold temperatures of the surrounding seafloor (close to 2°C), these pockets are warm (10°–27°C). According to the Smithsonian Institution, several dozen worms (a 1.5-m-long worm from the rift, *Riftia pachyptila* Jones, was named after Smithsonian worm expert M. L. Jones—*Science*, July 17, 1981), were collected by the *Alvin* crew from colorfully named warm pockets along the rift such as the 'Dandelions,' the 'Garden of Eden,' and the 'Rose Garden.' Research done by several international groups determined that there was little or no organic material in the surrounding mud from which the worms were extracted; that left only one possibility—the worms somehow could live, and thrive, on a byproduct of hydrogen sulfide. Close examination of the long body trunk portions of the worms revealed tiny crystalline grains of pure sulfur, evidence of some sort of mechanism that was capable of breaking down H_2S, the sulfur being left as a precipitate. As a result of studies of the worms (several results on *Riftia pachyptila* Jones are reported in the July 17, 1981, issue of *Science*, pp 333–348), it was deduced that the mode of taking nutrition used by the worms involves a detoxification step that reduced the sulfide chemically. There are complex steps of catalysis and synthesis of carbohydrates and proteins by enzymes in bacteria that live in the worms. The carbohydrate and protein nutrients thus produced are taken up by the muscle tissue of the worms, the result of an ideal symbiosis.

The growth rates of the rift seafloor animals seem to reflect the high efficiency of the automorphic nutrition process. Mussels that have been studied from the rift have growth rates of 1 cm per year, considered among the highest for deep-sea organisms, and clams are observed to grow at 5 times that rate.—*PMB* ⊠

EOS
TRANSACTIONS, AMERICAN GEOPHYSICAL UNION

The Weekly Newspaper of Geophysics

Send double-spaced manuscripts (four copies) to *Eos*, AGU, 2000 Florida Avenue, N.W., Washington, D.C. 20009, or send them directly to one of the associate editors with a copy to the above address.

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Views expressed in this publication are those of the authors only and do not reflect official positions of the American Geophysical Union unless expressly stated.

Cover. Amphibolite-grade rocks of the Lower Paleozoic Shoo Fly Complex in Tuolumne and Mariposa counties, California, comprise the most pervasively deformed basement rocks of the west central Sierra Nevada. In this oblique photo of a typical Shoo Fly psammite, F_2 isoclinal folds deform a penetrative mylonitic foliation (S_1) which is developed along axial planer to intrafolial isoclines. Near the top of the photo note the eyelolds caused by augenpoelition of folding episodes. Spaced ductile shear zones (S_3) are related to a third phase of folding not shown here. The third structures are isoclinal and sheath folds with significant shearing along S_3. The third structures progressively grade into a blastomylonitic foliation near the Calaveras-Shoo Fly Thrust—a probably deep-seated, cryptic suture. In the vicinity of the thrust, older structures are metamorphically overprinted and obliterated by the third-phase mylonites. Move away from the thrust (as shown here) the older metamorphic fabrics, which are themselves often mylonitic, predominate. Brittle conjugate cleavages are a product of Mesozoic orogenesis. (Photo by Charles Merguerian of Lamont-Doherty Geological Observatory and Hofstra University.)

Magnetospheric Cleft

The magnetospheric cleft is an opening between the earth's magnetic field and the interplanetary field associated with the magnetic poles. Charged particles entering the earth's upper atmosphere cause the airglow or aurora which occurs in the polar regions. At this time of year, as the sun approaches winter solstice and is below the horizon in northern Canada, atmospheric conditions can be studied on the 'sunside' of the earth as they appear in the dark from the ground. The cleft offers a unique opportunity to study particle acceleration mechanisms in a regime that is less structured in space and time, as opposed to the highly dynamic nightside auroral region, yet is equally interesting and physically rewarding.

The National Aeronautics and Space Administration and the National Research Council (NRC) of Canada will hold a cooperative, sounding rocket program in the Northwest Territories of Canada to study the dynamics of the cleft. Five large rockets carrying some 30 experiments will be launched into the prenoon, noon, and postnoon magnetospheric cleft region this fall. Ground-based instrumentation stations were installed this past summer at Cape Parry and Sachs Harbor, N.W.T., as well as additional launch support and accommodation facilities at Cape Parry.

There are practical as well as scientific reasons for this study because what happens in this region can cause problems ranging from communications disruptions to pipeline corrosion and, in ways not yet fully understood, can influence long-term weather patterns. The primary goal of the Cleft Energetics, Transport and Ultraviolet Radiation (CENTAUR) Project will be a comparison of mechanisms responsible for the production of Birkeland currents—great sheet currents of electricity that run into and out of the ionosphere around the auroral ovals—and the associated energization of charged particles in the pre- and postnoon magnetospheric cleft. In particular, the anticipated difference in the direction of the electric field downward on the morningside and upward on the eveningside implies different mechanisms involving different charge carriers. Data will be acquired by an assortment of ground instrumentation and sounding rocket payloads instrumentad with sensitive scientific experiments. Some anticipated results are *(a)* determination of the mechanism(s) responsible for particle acceleration in the cleft; *(b)* delineation of differences or similarities between pre- and postnoon acceleration processes (i. e., how can morning electron arcs be produced when the overall parallel electric field has the wrong sign); *(c)* verification of the presence of tangential (shear) discontinuities in the cleft ion flow (region of no electric field) and the scale size of the null electric field (zero flow) (is it as small as the local ion gyroradius?); *(d)* determination of the spatial relationship between ion shear flows, field-aligned currents, particle acceleration (inverted V's), dayside auroral arcs, and associated waves; *(e)* observation and analysis of plasma instabilities generated by currents. Special interest will be centered on the field-alignment currents by which the ion cyclotron instability is known to be generated. Also it is possible that the reversal in plasma flow across the current sheet can generate the Kelvin-Helmholtz instability.—*PMB* (source NASA) ⊠

Computers More Capable, Less Costly

During the past four decades of computer development, diminishing size of the integrated circuit has led to exponential increases in the capability of semiconductor chips and a steady decrease in the costs of computing. The size reduction of circuit components has resulted in a series of problems of an ultimate limit decrease and in the introduction of natural smallness barriers involving quantum effects. Techniques for fabricating microminiature chips are size limited for similar reasons. There is a marked increase in research being done in submicrometer dimension circuitry. Recently, Cornell University dedicated a new multimillion dollar building to be headquarters for the National Research and Resource Facility for Submicron Structures.

The increase in reliability of miniaturized integrated circuits in computer application over the past four decades is quite impressive. Figure 1 shows a plot of the semiconductor chip capability in computer-circuit function per chip versus time in years. Significant benchmarks in this logarithmic increase are commarcent development of the transistor itself in 1957, the integrated circuit in the early 1960's, the one-chip calculator in 1970, and the exponential random access memory circuits during the last decade.

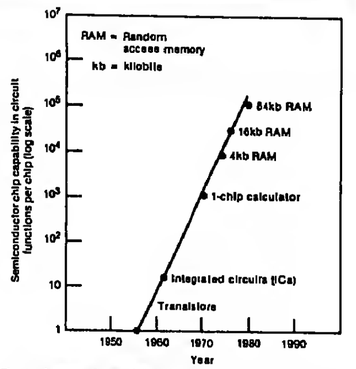
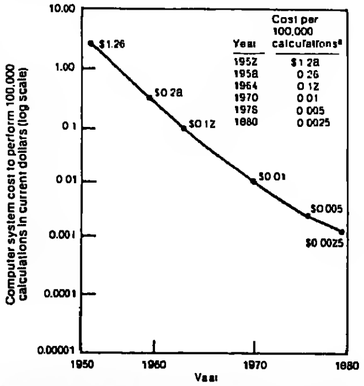


Fig. 1. Increase in capability of semiconductor chips from 1956–1980.

In the same time period, costs of the circuits and devices that utilize them are dropping rapidly. According to a recent report by the Congressional Office of Technology Assessment (OTA) (Computer-Based National Information Systems, OTA, 1981), the costs of storing and processing are so low now that the effects on society are 'as dramatic as those caused by the invention of the printing press.' The drop in average computer system costs per 100,000 calculations in the time span 1952–1980 is shown in Figure 2. The cost per 100,000 calculations in current dollars is plotted against time. These costs went down from $1.26 in 1952 to $0.0025 in 1980 (per 100,000 calculations).



Year	Cost per 100,000 calculations*
1952	$1.26
1958	0.26
1964	0.12
1970	0.01
1978	0.005
1980	0.0025

*Cost per 100,000 calculations is based on data for the following IBM computer systems (with year in parentheses): 701 (1952); 7090 (1958); 360/50 (1964); 370/155 (1970); 3033 (1978); 4300 (1980).

Fig. 2. Drop in average computer system cost per 100,000 calculations from 1952–1980.

The limits to continued lowering of costs and increases in miniaturized circuit capability are rapidly approaching. According to a brief report describing the new Cornell Submicron Facility (*Industrial Research and Development*, November 1981), as the circuits get smaller '. . . familiar rules [of physics and chemistry] no longer apply, owing to quantum mechanical effects.' A major project in the research of microcircuits is ultra-small-scale electron beam etching of semiconductor chips. It is now possible to etch lines with widths less than 15 Å on a circuit substrate. Light-ion beams (hydrogen ions) are being used for the same purpose, but to avoid electron scattering effects (the 'small proximity effect'). High resolution in etching and imaging circuits onto substrates is being advanced.—*PMB* ⊠

Earth Sciences Grants

As part of a 4-year, $5-million program by the Atlantic Richfield Foundation, 14 departments at 10 universities will receive grants to support doctoral students and junior faculty in geology and geophysics. The Atlantic Richfield Foundation will provide a total of 40 grants of $125,000 each to specific departments at 30 universities (10 universities will receive two grants each).

For each grant, $25,000 will be applied annually for 4 years for fellowship support of outstanding doctoral students selected by the department receiving the grant. The fellowships are intended to encourage greater interest in teaching careers. The other $25,000 of the grant will be for the support of junior faculty. The funds are to be supplied at the discretion of the receiving department and are primarily for salary supplements and summer stipends or for new equipment and laboratory expenses.

The universities and departments that will receive the grants, according to the Atlantic Richfield Company, are the Colorado School of Mines, geology and geophysical engineering departments; Texas A&M University, geosciences department; University of Southern California, geological sciences department; University of Colorado, geology department; Columbia University, geological sciences department; Louisiana State University, geology department; University of Minnesota, geology and geophysics departments; University of Oklahoma, geology and geophysics departments; University of Wisconsin, geology and geophysics departments; and Yale University, geology and geophysics departments.

Nation's Water Picture Better But Southeast Still Dry

The flow of the nation's 'Big Five' rivers, representing stream runoff from about half of the conterminous United States, increased during November and was 13% above normal for the month, according to the U.S. Geological Survey. USGS scientists said flow of these rivers—the Mississippi, St. Lawrence, Ohio, Columbia, and Missouri—increased from 483 billion gallons per day (bgd) during October, a rate which was 2% above normal for the month, to 553 bgd during November. Because of the large area draining into the Big Five, their combined flow provides a quick, useful check on the pulse of the nation's water resources. The Big Five flow has been above average for the last 8 months.

As a further indication of the generally healthy water situation, the USGS reports that over 70% of the 187 key index gaging stations across the country reported normal to above-normal streamflow during November. Conditions in the Southeast and scattered parts of the central and western states, however, remain well below normal.

Working in cooperation with federal, state, and local officials, the USGS compiled the following highlights of water resources conditions across the country in November:

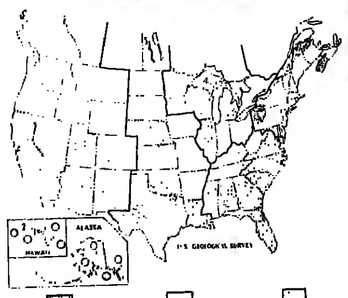
• *Big Five.* Individual flows of the Big Five for November: Mississippi River near Vicksburg, Miss., 229 bgd, 17% above normal and 28% above October's flow; St. Lawrence River near Massena, N.Y., 192 bgd, 20% above normal, but 1% below last month; Columbia River at The Dalles, Ore., 56 bgd, 1% below normal, but 2% above October; Missouri River at Hermann, Mo., 39 bgd, 10% above normal and 14% above last month; and the Ohio River at Louisville, Ky., 37 bgd, 8% below normal, but 64% above October.

• *Southeast.* Two key streams set new record lows as the dry spell in the Southeast continued. Twenty-six of the 32 key index stations in the eight coastal states from Virginia south to Florida and west to Louisiana reported below-normal streamflow during November. In addition, parts of eastern Tennessee and Kentucky also reported below-normal flows.

As in October, monthly flows were below normal at all six of the index stations in Florida. In Georgia, three of the state's four index stations reported below-normal flows.

Surface- and groundwater levels were below normal in Virginia and the Carolinas. The usual seasonal flow pattern in Virginia is for streamflow to take an upturn during November, but, in contrast to the usual trend, flows on all four of the state's key streams declined and were below normal.

Streamflow during November



Above normal (within the highest 25 percent of record for this month)

In normal range

Below normal (within the lowest 25 percent of record for this month)

Groundwater levels in North Carolina remained 0.5 to 2.5 feet below the long-term average.

• *Northeast.* Streamflow was in the normal range throughout most of the Northeast, with 18 of 25 key index stations from New England to Maryland reporting normal monthly flows. In contrast, Long Island, central Maryland, and most of New Jersey reported below-normal flows.

Groundwater levels generally rose in New England where 50 of the 58 key index wells in Massachusetts, Vermont, New Hampshire, and Rhode Island reported levels above those measured last month. The rise brought half of the key wells up to levels at or above the long-term average for November. Groundwater levels increased throughout upstate New York and in most of Connecticut. In contrast, three key wells in Maryland set record lows for November.

• *Middle Atlantic.* Freshwater inflow to the Chesapeake Bay, representing stream runoff from a 65,000 square-mile area of the Middle Atlantic states from New York to Virginia, averaged 32 bgd, 9% below the average November inflow of 35 bgd. Inflow to the Bay has averaged below normal for most of the last 18 months.

• *Great Lakes and Midwest.* Streamflow and groundwater levels were in the normal range in most of the Great Lakes region and Midwest, although flows were below normal and several key wells fell to record lows in parts of the Midwest. For example, index stations in Nebraska, Iowa, and Kansas indicated below-normal streamflows, and observation wells in Kansas, Arkansas, and North Dakota established new lows.

• *West.* Flow conditions were in the normal range in most western states, except for Montana and parts of Arizona and New Mexico, where streamflow averaged below normal, and California and Utah, where streamflow averaged above normal. Three wells tapping the basalt aquifer (water-bearing rock formation) beneath the Snake River Plain in Idaho reached new month-end lows. (Photo credit: U.S. Geological Survey, Department of the Interior.)

Forum

Meteorological Rocket Network Archives

The Meteorological Rocket Network (MRN) has provided synoptic observation of middle atmospheric (25–60 km) wind and temperature structure for more than two decades since its initiation in 1959. More than 35,000 small meteorological rockets have been deployed into the stratospheric circulation (SC) from more than 30 stations scattered over the earth, with current accumulation rates of roughly 1000 soundings per year. Archives of this MRN development have been assembled at the University of Texas at El Paso, and this permanent repository for past and future MRN data and artifacts will be dedicated on February 2, 1982. All atmospheric scientists are welcome to contribute to, take part in dedication of, and make use of all information contained in these archives.

Missile range meteorologists implemented small meteorological rocket development during the 1950's to satisfy requirements for mesoscale atmospheric structure data during rocket tests. They cooperated in this venture to assure efficiency, and through this cooperation they opened a new world of dynamical structure unknown to previous generations. Efforts to maximize returns from meteorological rocket sampling through synoptic coordination have revolutionized knowledge of SC structure at the gross end of the turbulent spectrum. At the same time, the necessity of developing small and inexpensive rocket observational systems has produced sensitivities which reveal prolific small-scale turbulence and a viscous nature of the upper atmosphere. Notions that flows are laminar in the upper atmosphere and free of highly significant eddy transport processes, and/or that any features observed there have certainly propagated upward are eliminated from rational scientific analysis by these MRN results.

MRN data have doubled the synoptically observed atmospheric volume and have revealed detailed knowledge of (*a*) interhemispheric flows between SC monsoonal circulations during 'winter storm periods,' which serve to unify and mix the global upper atmosphere; (*b*) explosive warming events in polar winter stratopause regions with wind and temperature variations of several hundred knots and as much as 100°C over a few days time; (*c*) diurnal tidal circulations with tens of knots amplitude around a roughly 15°C stratopause heat wave which serve to stir mesospheric and dynaspheric regions (50–100 km); (*d*) a highly turbulent and viscous upper atmosphere.

These MRN results make it impossible to adequately model environmental support for space age technology without current knowledge of all aspects of what is obviously a unified atmospheric dynamical system.

A primary message of MRN synoptic SC investigation is that the upper atmosphere is not the static place that had been assumed. In reality, the upper atmosphere is a highly turbulent and variable region. This dynamic nature emerges from a reduced ambient density medium which serves to amplify traveling perturbations that are commonly damped out of most lower atmospheric observations as inconsequential. Viscous inducing processes that accompany dissipation of these waves communicate the underlying structure of the earth's surface and lower atmosphere to the rarefied upper atmosphere and reveal the total unified atmospheric structure. This inhomogeneous source of energy input is incorporated into local dynamical structures that span the entire turbulent spectral range, from synoptic events of hemispheric dimensions to cascading dissipation of smaller and smaller internal waves into thermal structures.

Failure of models based on static assumptions to yield realistic models of special features of upper-atmospheric structure, such as noctilucent cloud formations, sudden warmings, dynamo current motivation, airglow, and auroral activity, as well as general ionospheric structure, is easily understood in the face of this intense turbulent activity. Chemical and electrical structures of the chemisphere and ionosphere are highly dependent on eddy transport structures, as is the water vapor structure required to support noctilucent cloud formation in mesopause regions. Interactions between the earth's neutral atmosphere and the near-solar environment are similarly dependent on viscosity produced by much larger eddy transport coefficients, which are now known to dominate upper atmospheric regions.

The Meteorological Rocket Network Archives (MRNA) consist of a complete set of MRN data reports (166 volumes), books that deal with MRN development and data analysis, scientific reports, manuals, organizational and administrative reports, and examples of rocket and sensor hardware. A history of the MRN effort has been prepared to summarize this twofold expansion of synoptic meteorology and to provide a ready reference (more than 300 entries) for all scientists of the contents of the MRNA. All atmospheric scientists are invited to acquaint themselves with these archives so that they can make full use of MRN data to discern the unified atmospheric structure which is now known to exist. Inquiries about accumulation, dedication, and use of the MRNA should be addressed to Willis L. Webb, Schellenger Research Laboratory, University of Texas at El Paso, El Paso, Texas 79968 (telephone: 915-747-5552).

Willis L. Webb

New Publications

Estuarine Hydrography and Sedimentation

K. R. Dyer (Ed.), Cambridge University Press, New York, ix + 230 pp., 1979, $39.50.

Reviewed by James P. Bennett

An extremely wide variety of disciplines can often become involved in even the simplest estuarine-water-quality study. The complexity of processes combined with cumbersome logistics and the tremendous expense of conducting estuarine studies make it imperative that all possible influencing factors be anticipated in data-collection program design and execution. Dyer's stated purpose is to provide estuarine researchers and students with 'advice on techniques of analysis and ways of interpreting data which are rather foreign to them, even though they are within the general area of estuarine studies.' The book is, however, not intended to be a cookbook but be a source in which techniques are outlined together for comparison with references to other publications for details. The book is a compilation of contributions, and a few of the authors are less successful than others in achieving Dyer's objectives; but, by and large, it is a worthwhile addition to estuarine research literature.

The first chapter introduces the physical and hydrodynamic framework. It has an excellent section describing the classification of estuaries with respect to circulation types and another section that emphasizes the recently appreciated fact that classical circulations are frequently interrupted by flow patterns induced by weather. The chapter also discusses the interactions between sediment and circulation that produce the turbidity maximum and increase the trap efficiency of estuarine systems. The chapter has an excellent bibliography as well.

Tidal measurement is the topic of the second chapter. It emphasizes the importance of referencing tide gages to local datum and gives troubleshooting hints and check procedures to ensure reliable operation of automatic float gages. It does not, however, include the techniques of (1) using a measuring tape instead of a wire to connect the pen and float; (2) using a portable, clear plastic stilling well to read the staff gage; or (3) obtaining common datum for several gages on the same estuary. Neither does the section discuss the importance of precise timing of tide records (or modern quartz timers) in running and calibrating digital hydrodynamic models. Also, few of the references in chapter 2 would be readily available to U.S. readers.

Chapter 3 outlines hydrographic surveys, which includes position fixing and depth sounding, whereas chapter 4 covers side-scan sonar and reflection seismic profiling. With the exception of the optical position fixing techniques, the procedures discussed in these chapters are 'equipment-dependent,' so manufacturer's operating manuals should be carefully consulted in designing sampling programs. Reading side-scan and seismic profiling charts is still very much of an art, so expert help should always be obtained in interpreting these records.

Estuarine bottom sediments provide homes and food sources for many organisms. Sediments entrap many pollutant materials and are important in recycling nutrients. Their size composition reflects local water dynamics, their mineralogy reflects source material, and the combination of these two characteristics may be indicative of contrast between prevailing modern and prehistorical transport processes. With the exception that it omits discussing the Ponar Grab, chapter 6 is an excellent review of the principal methods of obtaining sediment samples, the analytical techniques used to determine the particle size distributions of these samples, and how these analyses may be interpreted to provide information about the environment from which they were collected. This chapter also has a complete and relatively up-to-date bibliography.

Circulation patterns in most estuaries are such that these systems are essentially perfect traps for suspended sediment. Underestanding sediment transport is thus the key to understanding shoaling, pollutant dynamics, and many other aspects of estuarine behavior. Chapter 8 deals with determination of suspended material concentration, the properties of this material, and the interpretation of the results of these analyses. The chapter contains a worthwhile discussion of the difficulty of obtaining representative values for in situ particle density, size distributions, and fall velocities. It also provides a concise review of the literature on the computation of sediment fluxes and the processes associated with turbidity maxima in estuaries with different types of circulation.

Almost every estuarine study includes some form of measurement of current velocity, water temperature, and salinity. Chapter 7 discusses the spatial and temporal variability of these parameters in relation to rational design of a sampling program. It discusses actual collection of these data and presents a computer program that provides a standardized analysis procedure. Following this, net discharge and flux computations are defined, and a numerical example is given to illustrate the importance of using the proper definition to calculate tidal-cycle average values.

The book provides a good introduction to estuarine hydrography and sedimentation. It emphasizes processes, outlines techniques, and points to pitfalls without dwelling on detailed procedures. With one or two exceptions, the references listed are adequate for readers requiring more detail in particular study areas. The book is generally successful in achieving the editor's purposes, and this reviewer is anticipating the appearance of the promised companion volumes on estuarine chemistry and estuarine biology.

James P. Bennett is with the U.S. Geological Survey, Reston, Va.

The Ore Minerals and Their Intergrowths, 2nd ed.

Vol 35, International Series in Earth Sciences, 2 vols., P. Ramdohr, Pergamon, New York, xxxvii + 1207 pp., 1980, $200.00.

Reviewed by Paul B. Barton, Jr.

Paul Ramdohr, professor of mineralogy, Heidelberg University, Heidelberg, Federal Republic of Germany, is a revered institution among students of ore deposits. For half a century he has been the leading authority on ore minerals and their textural interpretation. His third German (and first English) edition (1969) of this title is a standard reference. His descriptive mineralogical work and presentation of a wide variety of ore textures are without peer.

The author and publisher are commended and thanked by this monolinguistic reviewer for publishing this book in English editions, in addition to those in German. The sentence structure is often Teutonic, but in only a few places was this reviewer left mystified (e.g., p. xix, lines 7–11; and the last sentence on page 13). In the course of review, my copy of volume 1 logged several thousand miles in my briefcase; the page binding is now showing signs of wear, and I am concerned for its longevity as a shelf reference in the microscope laboratory.

The new edition notes more than 400 ore and gangue mineral species, a quarter of them new since the previous edition. It is for the mineral descriptions that one seeks out *The Ore Minerals and Their Intergrowths*, and in this area Ramdohr has kept up rather well. However, most of the new minerals are very terse'y noted, and the beautiful photographs so characteristic of Ramdohr's work are seldom given for the newer minerals.

The book begins with 78 pages of genetic systematics dealing with the processes that produce ore minerals and continues with about 200 pages on ore textures and their general interpretation. The most valuable and voluminous part of the book is the systematic description of the ore minerals, which is nicely supplemented by many black-and-white photographs of the minerals and their textures. More than 800 photographs provide a remarkable catalog of mineral textures and show an amazing perfection in low-relief surface preparation. New photographs constitute about 15% of the total. Ramdohr places great emphasis on oil-immersion optics, even for low magnification; thus he achieves a contrast between minerals that is considerably accentuated beyond the images that those of us accustomed to dry optics may remember. The second English edition devotes 85 pages to 'Elements and Intermetallic Compounds,' 47 pages to 'Alloy-Like Compounds and Tellurides,' 452 pages to 'Common Sulfides and "Sulfosalts",' 108 pages to 'Oxidic Ore Minerals,' and 123 pages to 'Gangue Minerals and Non-Opaque Oxide Ore Minerals.' A 20-page table of 'New Reflectivity Values' is inserted in a pocket at the back of the first volume; it is the most up-to-date feature, as it cites 1976 and 1977 references. A 37-page locality index, a 1135-entry bibliography, a 1-page alphabetical subject index (far too brief), and a 6-page mineral index are included. Ramdohr is particularly thorough in his treatment of the iron-titanium oxides and reduced uranium minerals, and the overall coverage is very comprehensive. The variety is tremendous, and ideas for additional work abound. In contrast, transmitted light study of the transparent ore minerals, an area of rapidly growing importance (for example, see McLimans, Barnes, and Ohmoto, *Econ. Geol.*, p. 351, 1980, or Barton, *Mining Geology*, Japan, p. 293, 1978), receives very little discussion.

The editing and technical reviewing could have been much more thorough. The scales of four photographs were changed by about 50% from the first to the second English edition. In each photograph the statement about magnification was that of the earlier version. The photographs in the new edition are generally, but by no means universally, superior to the older edition, being of higher contrast and sometimes in sharper focus. Unfortunately, most of the captions come directly from the earlier edition, and all too often one finds that 'grey' may in fact be black. Some photographs have gained detail, but a few have lost it. Some downright errors appear, such as that on page 248, where the compressibility of the host crystal is blamed for the necessity for pressure corrections for some fluid-inclusion thermometry; the cinnabar-metacinnabar transition is listed as monotropic, despite clear evidence to the contrary by Dickson and Tunell in 1959 (*Am. Mineral.*, p. 471).

Because no author index is given, the reviewer may have overlooked a few citations, but overall the lack of modern references is surprising, and even where modern references are given in the bibliography, they are all too often ignored in the text. The second English edition contains about 1135 references (the dust jacket claims only 800!), but they represent little of the modern literature. The most recent references are two for 1977, the most recent decade begins in 1971, and the median date of citation is 1956—a full quarter century ago! This reviewer grants that all too often valuable older studies are neglected just because they are not 'modern,' but science is a dynamic thing, and reverence for history is only a part of knowledge. How, for example, can one justify even a half-page review of fluid inclusions by citing H. C. Sorby and W. H. Newhouse without even mentioning Edwin Roedder? Why should a list of 18 sources of information on geological thermometers give no references more recent than 1964? Why would a discussion of 'transformed textures,' including annealing and exsolution, not cite Richard Stanton or even contain the terms 'spinode' or 'coherent exsolution'? Why, in view of numerous definitive geochemical studies to the contrary by Julian Hemley and others, should the author state that 'hot alkaline waters' are the main agents of wallrock alteration? Why is there a 12-page discussion of 'colloidal' textures and no mention of Edwin Roedder's penetrating 1968 criticism (*Econ. Geol.*, p. 451) of so-called colloidal textures? Not even passing mention is made of the widely available 1974 Mineralogical Society of America Short Course Notes on Sulfide Mineralogy. The treatment of the Fe-S and Cu-S systems is far out of date for a 1980 publication, and Richard Yund and Gunnar Kullerud's 1968 publication (*J. Petrol.*, p. 454) on the Cu-Fe-S system is cited as though it were still in progress. Livingstonite ($HgSb_4S_8$) was shown by James Craig in 1970 (*Am. Mineral.*, p. 919) to contain that extra sulfur atom, yet the wrong formula is given. The discussions of the silver-gold tellurides bemoan the lack of an understanding of the phase relations but they ignore the careful studies of Louis Cabri (*Econ. Geol.*, p. 1689, 1965) and William Kelly and E. N. Goddard (*Geol. Soc. Am. Mem.*, p. 109, 1969). Many more such examples can be cited in which recent work has been ignored.

The distribution of publication dates in the list of references suggests either that the book is far out of date or that it chronicles the decay and demise of a particular corner of science; in fact, both are true. By the late 1940's, observation of ores had outdistanced theory, and the standard interpretations of the day gradually became recognized as unsatisfactory. Textural interpretation was viewed with suspicion and was performed perfunctorily. The practitioners of ore petrography of the 50's grew to rely on reflectivity and microhardness (and in the '60's on the microprobe); chemography was all too often substituted for careful textural interpretation. We are now seeing a renaissance of textural interpretations based on a steadily improving thermodynamic base, a rapidly growing reservoir of kinetic theory and data, and more thoughtful work with the microscope and microprobe. Ramdohr represents the 'old school' very creditably; in many respects, he helped pioneer the new wave without becoming part of it himself. It is well for modern workers to appreciate and benefit from the large body of older work so extensively presented by Ramdohr.

We have in the second English edition of *The Ore Minerals and Their Intergrowths* a book that was very well written in the mid-1960's and superficially revised in the late '70's to the extent of adding newly discovered minerals and a few excellent additional photographs of older ones. This is not a modern textbook for ore petrology; it is, however, by far the best compilation of superb ore photographs available. A first-rate microscopy laboratory needs a copy of Ramdohr, but after comparing both editions (and considering the high price of the second), this reviewer sees few compelling reasons to replace the older edition with the recent one.

Paul B. Barton, Jr., is with the U.S. Geological Survey in Reston, Va.

Classified

Crustal Geophysics/Tectonophysics or Sedimentology. The Department of Geology at the University of Kansas is seeking applicants at the assistant professor level for a potential addition-al tenure track position that will begin in August, 1982 or January, 1983. The appointment will be made in either crustal geophysics, tectonophysics, structural geology, or in sedimentology. The area in which the appointment will be made will depend upon the qualifications of the applicant and depart-mental needs. Duties include teaching in our introductory, undergraduate major, and graduate courses; advising students; supervising graduate student theses and dissertations; conducting origi-nal research; and providing service through admin-istrative and professional activities. Applicants must have Ph.D. in hand or expect to complete it by the end of the first year of employment at the Universi-ty. Minimum salary at the assistant professor level will be $23,000, if the position is authorized.

Crustal Geophysics, Tectonophysics or *Structural Geology.* We will consider applicants from all fields of geophysics and structural geology who are inter-ested in applying their expertise to understanding the structure and evolution of the earth's crust and who will complement the five existing geophysics faculty of the Department and the Kansas Geologi-cal Survey. The successful applicant will be expect-ed to cooperate with current faculty in offering courses at the undergraduate and graduate level that cover geophysics, tectonics, or structural geol-ogy.

Sedimentology We will consider applicants in any branch of sedimentology, but those with inter-ests in studying carbonate rocks, diagenesis and sedimentary geochemistry, or the relationships of sedimentation and tectonics are preferred. The ap-plicant will be expected to cooperate with present faculty in offering courses at the undergraduate and graduate levels that cover all aspects of the study of sedimentary rocks.

Persons who have responded to and/or advertisements this year for sedimentology and structural geology need not re-apply, but will be automatically considered in the event top candidates are about equally qualified, preference will be given to appli-cants whose areas of interests will complement those of the other faculty or who will participate in the department's summer field geology teaching program.

Priority will be given to applicants whose files are complete by February 1, 1982. Applicants should send a letter of application, resume (including publication list), transcripts of all college level work, and names of three references to:

Ernest E. Angino
Department of Geology
University of Kansas
Lawrence, Kansas 66045
Phone: (913) 864-3771

The letter of application should include a state-ment of current and planned research interests and of courses that the applicant feels qualified to teach.

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Applications are sought from all qualified people regardless of race, religion, color, sex, disability, veteran status, national origin, age, or ancestry

Structural Geologist/University of Wyo-ming. The University of Wyoming, Department of Geology and Geophysics seeks applicants for a tenure track appointment in structural geology ex-pected to be available beginning fall semester 1982 or earlier. Duties will include teaching of undergrad-uate and graduate courses in structural geology, supervising MS and PhD theses, and research in structural geology. Appointment at assistant profes-sor level is preferred, but applicants requesting op-pointment at higher rank will be considered. Salary open. Applicants must have PhD degree and be versed in quantitative theory as well as field appli-cations of modern structural geology and regional tectonics.

Applicants should provide, by January 1, 1982, a resume, three letters of reference, and a letter of application including a statement of current re-search interests and courses which the applicant feels qualified to teach. Applications should be sent to:

Dr. Robert S. Houston-Head
Department of Geology and Geophysics
University of Wyoming
Laramie, Wyoming 82071-3006.

The University of Wyoming is an equal opportuni-ty-affirmative action employer.

POSTDOCTORAL POSITION IN MARINE CHEMISTRY

Woods Hole Oceanographic Institu-tion invites applications for the position of Postdoctoral Investiga-tor. This position is being offered to basic research on the chemistry of the particle flux in the ocean and on the chemistry of sediment-seawater interactions, with particular emphasis on the transport of trace metals and radionuclides. Preference will be given to applicants with training in radiochemistry, trace-element analysis, surface chemistry, or geo-chemical modeling. Send resume and names of three references to:

Personnel Manager
Box 64P

WOODS HOLE OCEANOGRAPHIC INSTITUTION

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Hydrology: Tenure Track Position at As-sistant or Associate Professor Level. Can-didate should be a specialist in some quantitative aspect of hydrology with demonstrated skills in for-mulating hydrologic models, and a background in transport phenomena. Academic or professional credentials at Ph.D. level required. Starting date negotiable but could be as early as August 1982. Resumes, etc., should be received by March 1, 1982. Interested persons should request job de-scription from: Dr. E. S. Simpson, Chairman, Search Committee, Department of Hydrology and Water Resources, University of Arizona, Tucson, Arizona 85721.

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Princeton University/Water Resources Program, Department of Civil Engineering. Department of Civil Engineering invites applica-tions for a tenure track, three-year appointment at the assistant professor rank beginning on or before September 1982. Responsibilities include graduate and undergraduate teaching in hydrology and water resources, and participation in research into either hydrological processes associated with infiltration and unsaturated flow or chemical processes and transport in the unsaturated zone. Candidate must have Ph.D. degree with demonstrated teaching ability and scholarship.

Submit resume and references to:

Eric F. Wood, Director
Water Resources Program
Department of Civil Engineering
Princeton University
Princeton, NJ 08544.

Princeton University is an affirmative action/equal opportunity employer

Positions in Oceanography/VIMS. The Virginia Institute of Marine Science (VIMS)/School of Marine Science invites applications for two state funded, oceanography research and teaching posi-tions at the levels of Senior Marine Scientist. VIMS is a broad-based marine science establishment with a mission to provide sound and timely advice to executive agencies and the legislature and to conduct inclusive research programs. The School of Marine Science offers M.A. and Ph.D. programs with a faculty of 88 and 139 graduate students.

HEAD, DEPARTMENT OF GEOLOGICAL OCEANOGRAPHY (#113)

Applicants are sought with research interests in determine sedimentary geochemistry, dynamics of cohesive sediment transport, or estuarine and coastal morphodynamics. For further information contact Dr. Robert Byrne (VIMS), 804-642-2111 (Ext. 173)

ESTUARINE AND COASTAL HYDRODYNAM-ICS (Position #204)

A physical oceanographer with a strong interest in interdisciplinary approaches to complex estuarine and continental shelf problems is desired. For fur-ther information contact Dr. Bruce Nelson (VIMS), 804-642-2131 (Ext. 244).

Candidates for both positions should have estab-lished research credentials and be dedicated to fur-thering the research and educational programs of the Institute. Demonstrated ability to generate ex-ternal support is expected. Salary range is $24,872 to $34,107 and faculty rank is commensu-rate with qualifications.

Applicants should send a comprehensive curricu-lum vita, reprints, and at least three letters of rec-ommendation by February 1, 1982, stating specific position of interest, to: Employment Manager, Per-sonnel Office, College of Wm & Mary, Williams-burg, VA 23185.

An equal opportunity/affirmative action employer.

Geophysical Fluid Dynamicist/Physical Oceanographer. Applications are solicited for a junior faculty position in ocean physics or dynamics to begin in the academic year 1982–83. Areas of interest to the Department include analytical, nu-merical and laboratory modeling of physical pro-cesses and phenomena in the sea.

Yale University is an equal opportunity/affirmative action employer and encourages women and mem-bers of minority groups to compete for this position.

Curriculum vitae, publications, and the names of three or more references should be sent by 31 De-cember 1981 to: Robert E. Gordon, Chairman, De-partment of Geology and Geophysics, P.O. Box 6666, New Haven, CT 06511.

Planetary Scientist. SUNY Stony Brook, The Department of Earth & Space Sciences, anticipates that a tenure track faculty position may become available for a PhD Planetary Scientist. Planetary Science within this department spans the range of planetary atmospheres, cosmochemistry, and plan-etary geophysics. The candidate should have a demonstrated record of accomplishment. The ap-pointee is expected to pursue an active research effort and will be responsible for teaching courses at the undergraduate and graduate level.

Send vitae and names of 3 references to: Dr. Roger Kroeke, Dept. of Earth & Space Sciences, SUNY Stony Brook, Stony Brook, NY 11794.

SUNY Stony Brook is an EO/AA employer. AK #229A

Faculty Positions. *Two Faculty Positions in Geology.* Tenure-track positions in geology, assist-ant professorships. Ph.D. preferred or equivalent experience. Fall 1982.

Petrologist-Mineralogist Candidate must be able to teach introductory geology, mineralogy, pe-trology, geochemistry, and optical mineralogy/pe-trography.

Invertebrate Paleontologist-Soft-Rock Geologist Candidate must be able to teach courses in invertebrate paleontology, micropaleontology, sedimentol-ogy, and historical geology. Additional expertise in recent marine environments highly desirable.

Applicants are expected to do research in their areas of expertise, and to lead students' field trips. Strong teaching and research commitments expect-ed. Submit applications with resume and copies of transcripts, and have three letters of recommenda-tions sent to the Chairperson, Department of Earth & Space Sciences, Indiana University-Purdue Uni-versity at Fort Wayne. Fort Wayne, Indiana 46805.

Indiana University-Purdue University is an equal opportunity/affirmative action employer.

Iowa State University of Science and Technology/Department of Earth Sci-ences.

Applications are invited for two tenure track facul-ty positions. The rank for each is at the assistant or associate professor level, dependent upon qualifi-cations. The successful applicants will be expected to develop strong research and graduate student programs. Teaching duties will include undergradu-ate and graduate courses in the areas of expertise.

National Science Foundation

The National Science Foundation, in performing its function of support of sci-entific research, seeks high quality professional staff selected from a broad range of disciplines to carry out the review and evaluation of proposals and to recommend for support those proposals which are most meritorious from the scientific point of view.

Vacancies to be filled in the Division of Atmospheric Sciences are in the fol-owing areas of interest:

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- *Solar Physics*
- *Oceanography*
- *Paleoclimatology*
- *Fluid Dynamics*
- *Aeronomy*

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PLASMA PHYSICIST

The Space Sciences Laboratory of The Aerospace Corporation has an opening available for a Member of the Technical Staff to work in the area of plasma wave research in magnetospheric and iono-spheric physics. We have current and future space flight oppor-tunities in this area. Applicants should have demonstrated their ability to develop instrumentation, conduct rocket or spacecraft experiments and to process and analyze data from such experi-ments. Candidates should have a PhD degree or equivalent in Physics, Geophysics or Space Sciences with a strong background in Plasma Physics.

For immediate consideration, send your resume to: **Margaret Bohnot, Professional Placement, Dept. 00199.**

The Aerospace Corporation

P.O. Box 92957, Los Angeles, California 90009

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Mineral Resources/Economic Geology: One posi-tion is in mineral resources/economic geology. An applied field orientation is preferred. Iowa State has established a Mining and Mineral Resources Re-search Institute and an interdepartmental minor in Mineral Resources in order to support and develop research and education in this area. In addition to the appointment in the Department of Earth Sci-ences there will be full opportunities to interact with these programs.

Geomorphology: The second position is in the general field of geomorphology. Additional exper-tise in an area related to geomorphology, such as groundwater, engineering geology or remote sens-ing is also desired. A person with an applied field orientation is being sought.

Each appointment will be on an academic year basis. Opportunities are available for summer teaching appointments. Salaries will be commensu-rate with qualifications. Application deadlines for both positions are February 15, 1982; later applica-tions will be accepted if a position is not filled. Posi-tions are both currently available and are expected to be filled no later than fall, 1982. For application information please write to:

Gert E. Nordlie
Department of Earth Sciences
253 Science I
Iowa State University
Ames, Iowa 50011

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Atmospheric Scientist. SASC, a leader in the software industry, has immediate requirements for an atmospheric scientist to conduct numerical research in the simulation of optical sensors operat-ing from satellite orbit. Position requires experi-ence with satellite data analyses and active sen-sors as well as experience on CYBER hardware. Requirements include Ph.D. in Space Physics with a minimum of three years relevant experience. SASC offers excellent company benefits including 3 weeks vacation and dental plan. Salary range $25,000 to $30,000. EOE. Contact Virginia Employ-ment Commission, 222 E. Queen Street, Hampton, VA 23669 (804)722-2841. Attn: Mrs. Olson.

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STUDENT OPPORTUNITIES

Graduate Research Assistantships. Environ-mental science at the Oregon Graduate Center. At-mospheric and aerosol physical research programs in theoretical modeling of anthropogenic effects on stratospheric ozone and global temperature and in-vestigation for sulfur and carbon aerosols. Degree pro-gram provides for intensive research experience and maximum student-faculty interaction. $7500 al-pend with remission of fees and tuition available to qualified Ph.D. students. Write: Dr. Douglas F. Bar-tlaky, Oregon Graduate Center, 19600 N.W. Walk-er Road, Beaverton, Oregon 97006.

Exxon Teaching Fellowship at University of Michigan-Geological Sciences. Applica-tions are invited for a three-year fellowship in the PhD program, supported by the Exxon Education Foundation. Annual stipends will be $12,000, $13,500, and $15,000 for the first, second, and third years, respectively, with full waivers for tuition and fees. The successful applicant will be a person who, at the time of the award, intends to pursue a college teaching career, is extremely articulate and has a demonstrably high quantitative and verbal aptitude, and is a U.S. citizen/permanent resident. Regular admission and financial support applica-tions must be received before February 1, 1982 to be considered. An extensive background in geolog-ical and cognate sciences is desirable. Unsuccess-ful applicants for the Exxon Fellowship are still eligible for our regular financial support. For further de-tails contact: Dr. Van der Voo, Chairman, Department of Geological Sciences, University of Michigan, Ann Arbor 48109.

Graduate Study in Oceanography/Oceano-graphic Engineering. Research Assistant-ships and research fellowships are available for graduate study in Physical and Chemical Oceanog-raphy, Oceanographic Engineering, and Marine Ge-ology and Geophysics leading to a Ph.D., or Sc.D. degree conferred jointly by the Woods Hole Ocean-ographic Institution and the Massachusetts Institute of Technology. The awards cover tuition and pro-vide an average monthly taxfree stipend of $540 to $590. Research topics available to student reflect the interests of the more than 100 doctoral scien-tists and engineers at WHOI and the faculties of ten different departments at MIT.

The program encourages applications from stu-dents with an undergraduate degree in any of the natural sciences or engineering. For additional in-formation please contact: The MIT/WHOI Joint Pro-gram in Oceanography/Oceanographic Engineering at either: The Education Office, The Woods Hole Oceanographic Institution, Woods Hole, MA 02545, or Room 54-911, The Massachusetts Institute of Technology, Cambridge, MA 02138.

Graduate Research Assistantships in Ma-rine, Atmospheric, and Sedimentary Geo-chemistry. Available for studies leading to M.S. and Ph.D. degrees with specialization in the geo-chemistries of oceanic, estuarine, and sedimentary trace elements and nutrients, atmospheric particu-lates and gases, and sedimentary radioisotope chem-istry. Stipends for incoming M.S. candidates are ~ $7,000 for 9 mos., with graduate summer awards up to $2800; and for advanced Ph.D. students are up to $10,000 for 12 mos. Persons with strong un-dergraduate majors in the basic sciences are en-couraged to apply. Contact Prof. P. N. Froelich, Dept. of Oceanography, Florida State University, Tallahassee, FL 32306, (904)644-6700.

Geochemistry: Graduate research assistantships are available for studies leading to the M.S. and Ph.D. degrees in geochemistry. Areas of research include: organic geochemistry of petroleum, coal, and sediments; isotope geochemistry of sedi-ments and rocks; and trace element geochemistry of sediments and rocks. Applicants should have a strong background in chemistry and mathematics. Contact Dr. Isaac R. Kaplan, Department of Geology, University of California, Los Angeles, CA 90024.

Graduate Research Assistantships in Geo-physics. Graduate research assistantships are available for studies leading to the M.S. and Ph.D. degrees in geophysics. Areas of research include: seismology, geomagnetism, geodynamics, and geophysical fluid dynamics. Applicants should have a strong background in physics and mathematics. Contact Dr. Isaac R. Kaplan, Department of Geology, University of California, Los Angeles, CA 90024.

Graduate Research Assistantships in Geo-chemistry. Graduate research assistantships are available for studies leading to the M.S. and Ph.D. degrees in geochemistry. Areas of research include: organic geochemistry of petroleum, coal, and sediments; isotope geochemistry of sedi-ments and rocks; and trace element geochemistry of sediments and rocks. Applicants should have a strong background in chemistry and mathematics. Contact Dr. Isaac R. Kaplan, Department of Geology, University of California, Los Angeles, CA 90024.

Meetings

Rock Mechanics Symposium

January 29 is the deadline for abstracts of papers for the 23rd U.S. Rock Mechanics Symposium, to be held August 25–27, 1982, at the University of California at Berkeley. Theme of the conference is 'Issues in Rock Mechanics.'

Extended abstracts of not more than three to four pages (double-spaced pages), including one or two figures, should be sent to the Organizing Committee, 23rd U.S. Rock Mechanics Symposium, c/o Richard E. Goodman, Department of Civil Engineering, University of California, Berkeley, CA 94720. Authors will be notified by March 1; completed papers, ready for publication, are due May 1.

The annual symposium is sponsored by the U.S. National Committee for Rock Mechanics. A final program will be available in May. ⊗

IAHS Scientific Assembly

The International Association of Hydrological Sciences (IAHS) will hold its Scientific General Assembly at the University of Exeter, England, from July 19 to 30, 1982. Previously, the general assemblies have been held within the general assemblies of the International Union of Geodesy and Geophysics; 1982 will be the first year since its foundation in 1922 that IAHS will hold its own general assembly.

Six symposia, each organized by one of the IAHS commissions, are planned: advances in hydrometry; optimal allocation of water resources; improvement of methods of long-term prediction of variations in groundwater resources and regimes caused by human activity; recent developments in the explanation and prediction of erosion and sediment yield; hydrological aspects of alpine and high mountain areas; and effects of waste disposal on groundwater and surface water. Poster sessions and workshops, including one on remote sensing and one on hydrology in developing countries, are planned.

Accommodations for meeting participants will be provided at the university. Those wishing to stay outside the university are urged to book hotel accommodations early. Contact the Tourist Information Centre, Civic Centre, Dix's Field, Exeter, Devon, UK.

For additional information on the assembly, contact D. E. Walling, Chairman, Local Organizing Committee, Department of Geography, University of Exeter, Amory Building, Exeter EX4 4RJ, UK.

The IAHS Assembly is being held at the invitation of the Royal Society, and the City and University of Exeter, with the support of UNESCO, WMO, and the UK Overseas Development Administration. ⊗

EGS and ESC Meeting

The European Geophysical Society (EGS) and the European Seismological Commission (ESC) will meet at the University of Leeds, England, on August 23–27, 1982. A call for papers has been issued. Travel awards are available for young scientists.

In addition to nearly 30 symposia, workshops, and open sessions, meetings will be held of all the ESC subcommissions: data acquisition, theory and interpretation, microseisms, deep seismic sounding, focal mechanisms, earthquake predictions, and seismicity. Sessions will be held on the IASPEI Commission on Practice and on the IASPEI Commission on Controlled Source Seismicity. Several working groups and coordinating committees of the International Union Commission on the Lithosphere will also meet.

The symposia are divided into three sections: earth and planetary interiors and surfaces; hydrosphere and earth and planetary atmospheres; and interplanetary medium, magnetospheres, and upper atmospheres. Two society lectures entitled 'Rotating Fluids in Geophysics and Planetary Physics' and 'The Magnetosphere of Jupiter and Saturn' will be featured.

Travel awards are available for young scientists. Application forms are available from P. Steinhauser, Zentralanstalt fur Meteorologie und Geodynamik, A-1190 WIEN, Hohe Warte 38, Austria. March 31 is the closing date.

Potential contributors to the EGS symposia, workshops, or open sessions should send two copies of abstracts to J. Lemaire, Chairman, Program Committee, IAS, 3 Av. Circulaire, B 1180 Brussels, Belgium. For ESC symposia, workshops, or subcommissions, mail two copies of the abstract to J. M. Van Gils, Secretary of ESC, O. R. B., 3 Av. Circulaire, B 1180 Brussels, Belgium. One copy of the abstract also should be sent to the convenor of the sessions; the list of convenors, along with additional information and mailing circulars, can be obtained from J. T. Gleave, Special Courses Division, The University of Leeds, Leeds, LS2 9JT, U.K. (telephone: 0532 435036; Telex 557939 Expaih G.). ⊗

International Mine Water Congress

The First International Mine Water Congress of the International Mine Water Association will be held April 19–24, 1982, in Budapest, Hungary. The meeting is organized by the Hungarian Mining and Metallurgical Society and the Central Institute for the Development of Mining; the sponsor is the Department of Geosciences of the Hungarian Academy of Sciences.

Topics to be covered include geoscience and engineering for the prediction and control of the hazards and damages caused by mine water; protection of mining and the mine against hazard; environmental protection and mine water control; and the relationship between the control and utilization of mine water.

For additional information, contact Zs. Kesseru, Hungarian Mining and Metallurgical Society, H-1061 Budapest, Ankar köz 1-3, or Roy E. Williams, College of Mines, University of Idaho, Moscow, ID 83843. ⊗

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Copies of English translations of articles from Russian translation journals are available either in unedited form at the time of their listing in EOS or in final polished form when a journal is published. The charge is $2.00 per Russian page.

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Aeronomy

8310 Absorption and scattering of radiation
IDENTIFICATION OF ACETYLEN (C_2H_2) IN INFRARED ATMOSPHERIC ABSORPTION SPECTRA
J. Goldman (Department of Physics, University of Denver, Denver, Colorado 80208), F.J. Murcray, R.N. Blatherwick, J.R. Gillis, F.S. Bonomo, F.H. Murcray, D.G. Murcray, and I.M. Clouzeau.

Infrared atmospheric absorption spectra at ~0.03 cm^{-1} resolution obtained during a balloon flight made on 3/23/81 show absorption features attributable to C_2H_2. These features are used to derive a preliminary mixing ratio of ~25 ppbv near 9 km. This mixing ratio falls into the range of values we calculate for upper tropospheric C_2H_2 in a photochemical/transport model but well below values measured previously in samples collected by other researchers.
J. Geophys. Res., Ocean, Paper 1C1131

8410 Absorption and scattering of radiation
[services of waves]
CONTRIBUTION OF ENERGY SCATTERED TWICE TO THE OPTICAL, INFRARADIATION FIELD OF THE EARTH ATMOSPHERE
B.A. Fabr and T. Said (Institut für Astrophysik, Bonn, Germany, D-5300 Bonn, FRG)

Gas absorption calculations for the gaseous-mal helium resonance radiation field have shown that scattering processes attain increasing importance if line center regions are suppressed. An attempt a quantitative confirmation of this observational finding and reinvestigate the radiation transport problem in terms of contributions of different scattering orders on the basis of a two-dimensional partial frequency redistribution. The properties of the two important scattering orders are studied in detail. The dominance of the first scattering order with increasing line centre distance is explicitly shown. Beyond some critical line center distance the second order fastly grows to be proportional to the helium column densities.
J. Geophys. Res., Ocean, Paper 1A1450

Electromagnetics

0720 Electromagnetic theory
EFFECTS OF LATERAL IONOSPHERIC GRADIENTS ON ELF PROPAGATION
R. L. Field (Pacific-Sierra Research Corporation, 1456 Stoneridge Boulevard, Santa Monica, California 90404) and S. D. Jolley

This paper studies the propagation of the TEM ELF mode when the earth-ionosphere waveguide is not stratified. To treat a lateral discontinuity we start by replacing the wave equation as a two-dimensional integral equation. Numerical solutions show that such a discontinuity inherently (like a cylindrical reflector) produces a narrow aperture. Lateral diffraction, focusing, and reflection can cause the TEM mode to exhibit a strong amplitude pattern before the discontinuity, and a counterrotating pattern of maxima and minima beyond it. Such phenomena can contribute to the spatial fluctuations occasionally observed in ELF transmissions. The focusing and diffraction distortion when the transverse dimension of the disturbance approaches the width of the first lateral zone—typically, several megameters. The analysis models exceedingly widespread inhomogeneities, such as a disturbed polar cap or the day/night boundaries, as semi-infinite regions having plane boundaries. If these distant half-plane analytic expressions for the lateral reflection and transmission coefficients of the TEM mode. Reflection can be important in two situations: first, when a great-circle propagation path is nearly tangential to the boundary of the disturbed polar cap; second, when the TEM mode is obliquely incident on the day/night terminator—in which case a phenomenon analogous to internal reflection can occur.
Rad. Sci., Paper 1S1713

0770 Radio Oceanography
VARIABILITY AND MODEL RESIDUALS FROM THE SEASAT RADAR ALTIMETER
L.S. Fedor (NOAA/ERL/Wave Propagation Laboratory, Boulder, Colorado 80303 and G.S. Brown (Applied Science Associates, Inc. Apex, North Carolina 27502)

Comparisons between the SEASAT radar altimeter inferred estimates of significant waveheight (SWH) and wind speed with buoy measurements in two overflights are presented. Details of the "calibration" of SEASAT's measurement of $\sigma^0(0°)$ against the GEOS-3 radar altimeter are presented. The "sea-board" estimate of SWH is shown to be biased high by 0.1 m for SWH > 2 m. Comparisons of buoy observational findings and rainrestimate the radiation transport problem in terms of contributions of different scattering orders on the basis of a two-dimensional partial frequency redistribution. The properties of the two important scattering orders are studied in detail. The dominance of the first scattering order with increasing line centre distance is explicitly shown. Beyond some critical line center distance the second order fastly grows to be proportional to the helium column densities.
J. Geophys. Res., Ocean, Paper 1A1450

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Rad. Sci., Paper 1S1713

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J. Geophys. Res., Ocean, Paper 1A1450

0711 Remote sensing
LAYER CONTAMINATION OF WIND SPEEDS OBSERVED BY THE BASS, ASTMEXPED, AND SOUSY
S. J. Wentz (Remote Sensing Systems, Santa Clara, California) W. J. Cardoza (Communications, Inc., White Plains, New York) and L. S. Baker (Wave Propagation Laboratory, BSMRL, Boulder, Colorado)

Recent reported three wind speed microwave measurements at nonmonochromatic (BASS), an electromagnetic (ASTP), and a fine-frequency radiometer (SOUSY). The winds inferred by these three sources along with colocated in situ buoy measurements are examined for intercomparison. In general, the comparisons show an agreement at about 2 m/s with the three sources tracking each other quite well. For calm observations, all three measurements respond equally well to low winds, which appear in a significant discrepancy at high wind speeds. The BASS measurements are higher than the ASTP and SOUSY measurements, and at one end in the spectral data. All-radio comparisons between the BASS and SOUSY show a 2.5 m/s scatter on top of a bias that varies by about 1 m/s across the swath. In almost the agreement between BASS and SOUSY degrades somewhat. Both sources respond to the high wind speeds (25 m/s), with neither instrument experiencing saturation.
J. Geophys. Res., Ocean, Paper 1C1484

0771 Remote sensing
A PARAMETERIZATION OF EFFECTIVE SOIL TEMPERATURE FOR MICROWAVE EMISSION
E. J. Chaudhury (Hydrological Sciences Branch, NASA/Goddard Space Flight Center, Greenbelt, MD 20771) D. M. Schmugge and T. J. Wu

The observed microwave brightness temperature of soils depends upon the soil temperature profile, which is complicated by the emissivity, gives the brightness temperature, in terms of surface (T_s) and deep (T_d) soil temperatures as $T = T_s + C(T_d - T_s)$. A coherent radiation transfer model and a large data base of observed soil moisture and temperature profiles were used to calculate the best-fit values of the parameter C. For 1.5, 6.0, 11.0, 21.0 and 49.0 cm wavelengths, the C values are respectively 0.004 ± 0.004, 0.667 ± 0.008, 0.480 ± 0.010, 0.246 ± 0.009, and 0.008 ± 0.003. The parameterized equation gives results which are generally within one or two percent of the exact values. [Radiative transfer, soil moisture, microwave, remote sensing]
J. Geophys. Res., Ocean, Paper 1C1416

Ocean Sciences: AGU/ASLO Joint Meeting

A joint meeting of the American Geophysical Union's Oceanography Section and the American Society of Limnology and Oceanography will be held February 16–19, 1982, in San Antonio, Texas

Registration. Everyone who attends the meeting must register. Preregistration (received by January 29) saves you time and money, and the fee will be refunded if AGU receives written notice of inability to attend by February 8.

Registration rates are as follows:

	Preregistration	At Meeting (after 1/29)
Member	$55	$70
Student Member	$25	$40
Nonmember	$75	$90
Student nonmember	$32	$47

Registration for 1 day only is available at half the above rates. Members of American Geophysical Union, American Society of Limnology and Oceanography, Marine Technology Society, and American Meteorological Society may register at the member rates.

The difference between member (or student member) registration and nonmember registration may be applied to AGU dues if a completed membership application is received at AGU by May 19, 1982. Current AGU annual membership rates are: $20 members; $7 student members.

To preregister, fill out the registration form, and return it with your payment to the AGU Office. Your receipt will be included with your preregistration material at the meeting. Preregistrants should pick up their registration material at the preregistration desk at the El Tropicano Hotel, headquarters for the meeting. Complimentary badges for guests not attending the scientific sessions will be available at the registration desk.

Hotel Accommodations. Blocks of rooms are being held at the El Tropicano, the St. Anthony, and the Gunter hotels. Read the housing application and MAIL THE COMPLETED APPLICATION FORM TO THE HOUSING DEPARTMENT, San Antonio Convention and Visitors Bureau, P.O. Box 2277, San Antonio, Texas, 78298. MAIL EARLY to insure confirmation of your preferred hotel. DEADLINE FOR RESERVATIONS IS JANUARY 15, 1982. Please do not write or call the AGU office for room reservations.

Social Events. Complimentary refreshments will be served daily from 9:30 to 10:30 A.M., from 2:30 to 3:30 P.M., and again at the Ice Breaker immediately following the session on Tuesday evening.

A luncheon is planned for Wednesday in the Southwest Craft Center, one of the Southwest's finest examples of French architecture of the late 1800's. Fred Spilhaus, Executive Director of AGU will speak on Society Collaboration-Strength for Ocean Sciences. Reserve early as space is limited. Cost-$8.75 per ticket.

Program Summary

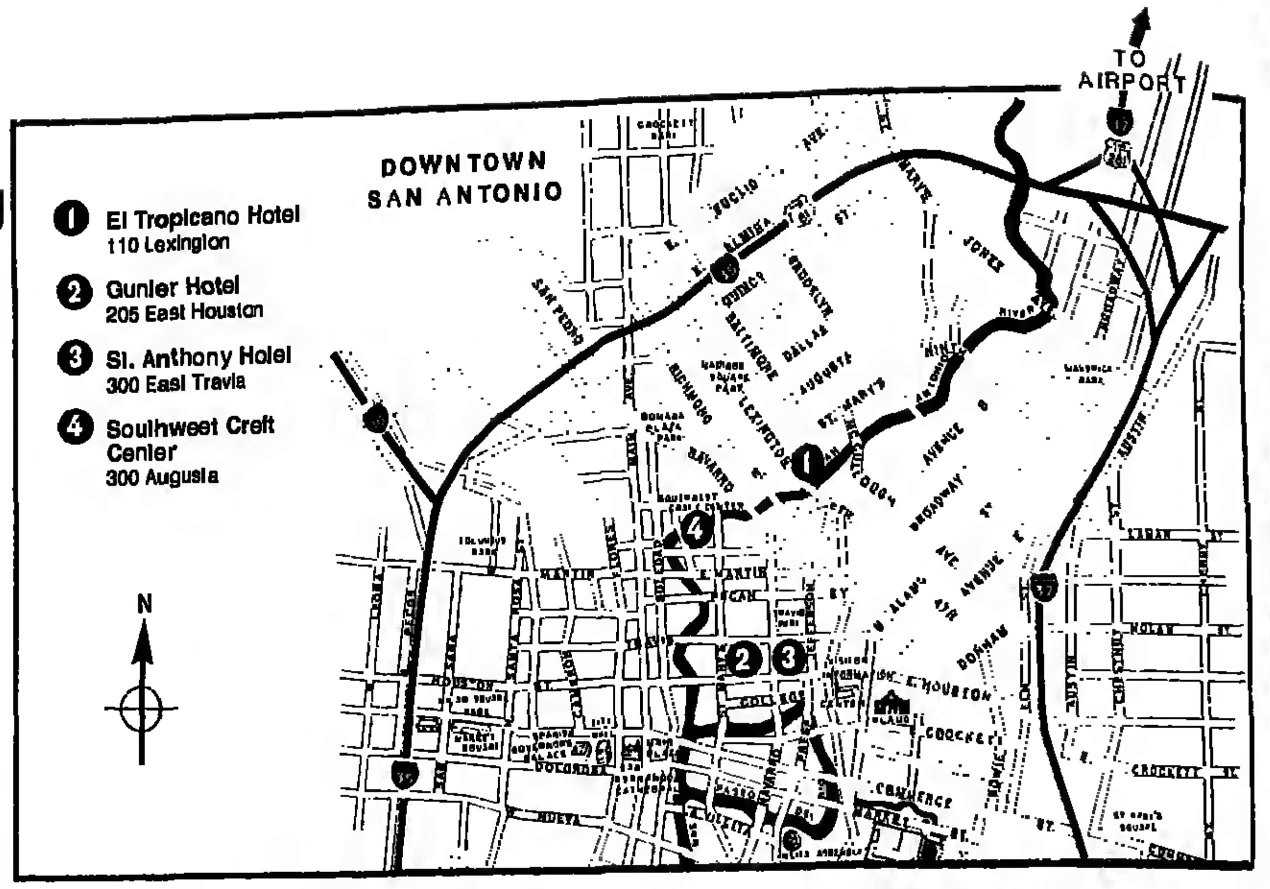
All of the sessions will be held in the El Tropicano Hotel.

Tuesday
- Particle Fluxes I (AM)
- Biology and Physics of Ice Edges (AM)
- Ocean-River Interaction (AM)
- Large-Lake Processes (AM)
- Rings (AM)
- Particle Fluxes II (PM)
- Biology and Physics of Ice Edges (PM)
- Ocean-River Interaction (PM)
- Large-Lake Processes (PM)
- Rings (PM)
- Marine Optics (PM)

Wednesday
- Large Oceanographic Program (AM)
- Biogeochemical Cycling (AM)
- SANOS (AM)
- Small-Lake Limnology (AM)
- Mesoscale Processes (AM)
- Large Oceanographic Programs (PM)
- Biogeochemical Cycling (PM)
- Geology and Circulation (PM)
- Small-Lake Limnology (PM)
- Mesoscale Processes (PM)

Thursday
- Anthropogenic Inputs (AM)
- Feeding Dynamics (AM)
- Particle Fluxes III (AM)
- Coastal Processes I (AM)
- Climate and Productivity (AM)
- Anthropogenic Inputs (PM)
- Gulf of Mexico Biology and Circulation (PM)
- Particle Fluxes IV (PM)
- Coastal Processes II (PM)
- Microscale Processes (PM)

Friday
- Microbial Dynamics (AM)
- PROBES (AM)
- Measurement Techniques (AM)
- Coastal Processes III (AM)
- Bioturbation (AM)
- Microbial Dynamics (PM)
- General Oceanography (PM)
- Measurement Techniques (PM)
- Trace Metals (PM)
- Bioturbation (PM)



Ocean Sciences: AGU/ASLO Joint Meeting

February 16–19, 1982
San Antonio, Texas

IMPORTANT INSTRUCTIONS

The San Antonio Convention and Visitors Bureau will make hotel assignments upon receipt of the official housing application, provided that it is properly filled out and all necessary information is given. All rooms will be assigned on a first come, first serve basis. All requests must be on this form. Telephone requests *are not* accepted. OFFICIAL HOTEL CONFIRMATION WILL ADVISE DEPOSIT POLICY. DO *NOT* SEND MONEY WITH THIS FORM.

Ocean Science Meeting
American Geophysical Union
Housing Department
San Antonio Convention and Visitors Bureau
P.O. Box 2277
San Antonio, Texas 78298

Cutoff date for reservations is January 15, 1982

HOTEL-MOTEL PREFERENCE: Indicate by number (1) (2) (3): Failure to list maximum number of choices will result in delay as form will be returned for additional selections.

El Tropicano Hotel ____	St. Anthony Hotel ____	Gunter Hotel ____	Arrival date ____
Single $37	Single $44	Single $35	
Double $47	Double twin $60	Double $41	Time ____ a.m. ____ p.m.
3 to a room $55	Double double $80	3 to a room $51	
4 to a room $63	King $78	4 to a room $61	
	3 to a room $80		Departure date ____

TYPE OF ACCOMMODATIONS DESIRED
- ____ Single(s) (1 person, 1 bed)
- ____ Double(s) (2 persons, 1 bed)
- ____ Twins(s) (2 persons, 2 beds)
- ____ Multiple(s) (3 persons)
- ____ Multiple(s) (4 persons)
- ____ Suite (1 bedroom; parlor)
- ____ Suite (2 bedrooms; parlor)

List below the names of persons occupying each room (INDICATE THOSE SHARING ACCOMMODATIONS)

NAME ____ TYPE OF ROOM ____

MAIL CONFIRMATION TO: (Please list only one person to receive acknowledgement. If this request is being sent in for a group of people, be sure others do not duplicate.)

(PRINT OR TYPE) Name ____ Address ____
City ____ State ____ Zip ____
Telephone No.: A.C.( ) ____

RETURN THIS FORM WITH PAYMENT TO:
Meetings Registration
American Geophysical Union
2000 Florida Ave., N.W.
Washington, D.C. 20009

PLEASE PRINT CLEARLY

NAME ON BADGE ____
AFFILIATION ____
MAILING ADDRESS ____
Telephone # ____
Address during the meeting if different than above ____

The program and meeting abstracts will appear in the January 19 issue of Eos, which is mailed to all members of AGU/ASLO in advance of the meeting.

Ocean Sciences: AGU/ASLO Joint Meeting
February 16–19, 1982
San Antonio, Texas

REGISTRATION FORM

Days you plan to attend
☐ Tuesday ☐ Wednesday
☐ Thursday ☐ Friday

Please check appropriate box. Members of sponsoring societies may register at the member rates.
- O Member AGU
- O Member ASLO
- ☐ Member sponsoring society.
  AMS–American Meteorological Society
  MTS–Marine Technology Society
- O Nonmember

Nonmembers
The difference between member (or student member) registration and nonmember registration may be applied to AGU dues if a completed membership application is received at AGU by May 19, 1982. Current AGU annual membership rates are: $20 Members; $7 Student Members.

Preregistrants
Your receipt will be in your preregistration packet. The registration fee will be refunded if written notice of inability to attend is received in the AGU office by February 8.

Office Use Reference Number

DEADLINE FOR RECEIPT OF PREREGISTRATION
January 29, 1982
(rates applicable only if received by January 29 with payment)

	More than one day	One day
MEMBER	☐ $55	☐ [illegible]
STUDENT MEMBER	☐ $25	☐ [illegible]
NONMEMBER	☐ $75	☐ [illegible]
STUDENT NONMEMBER	☐ $32	☐ [illegible]
ABSTRACTS (January 19, 1982, *EOS*)		☐ $[illegible]
LUNCHEON WEDNESDAY, FEBRUARY 15		☐ $[illegible]

Charge to: ( ) Visa ( ) Master Card
Card Number ____
Expiration Date ____
Signature ____
Other payments (Please identify) $____
Total enclosed $____
(All orders must be accompanied by payment or credit card information. Make check payable to AGU.)

Office Use: Code ____ Check No. ____

Exploration Geophysics

Geodesy and Gravity

Geomagnetism and Paleomagnetism

2960 Time variations, paleomagnetism
LATE CRETACEOUS-EARLY TERTIARY PALEOMAGNETISM OF ARUBA AND BONAIRE (NETHERLANDS LEEWARD ANTILLES)
Carole Stearns (Department of Geological Sciences, University of Michigan, Ann Arbor, Michigan 48109) Frederick J. Mauk and Rob Van der Voo

For a paleomagnetic study of the Upper Cretaceous of the Netherlands Leeward Antilles, we have analyzed 107 oriented samples from the complex [illegible] batholith and the diabase-schist-tuff formation on Aruba and 44 oriented samples from various igneous units of the Washikemba formation on Bonaire. Both alternating field (AF) and thermal demagnetization procedures were used to demagnetize the samples. Most of the cores yielded univectorial Zijderveld diagrams above 10-20 milliTeslas or 400°C. Virtual geomagnetic poles (VGP's) calculated from site means were then compared with equivalently aged poles from cratonic South America and other Caribbean sites. The Washikemba Formation of Bonaire and the diabase-schist-tuff Formation of Aruba yield poles that are similar to those of Guajira (Colombia) and the Caribbean Mountains of northern Venezuela, whereas they are rotated approximately 90° with respect to the pole for stable South America. The batholith on Aruba yields a pole which is rotated clockwise over approximately 20° with respect to the South American pole. Thus, our data strongly support the hypothesis that Aruba and Bonaire have been rotated clockwise by as much as 90° since the late Cretaceous. In addition, paleolatitudes calculated from the inclinations of the paleomagnetic vectors suggest that there was a northward drift with respect to South America of perhaps as much as 10° of the islands during the rotation, although this can hardly be called a statistically significant amount. (Paleomagnetism, Caribbean, microplate rotation).

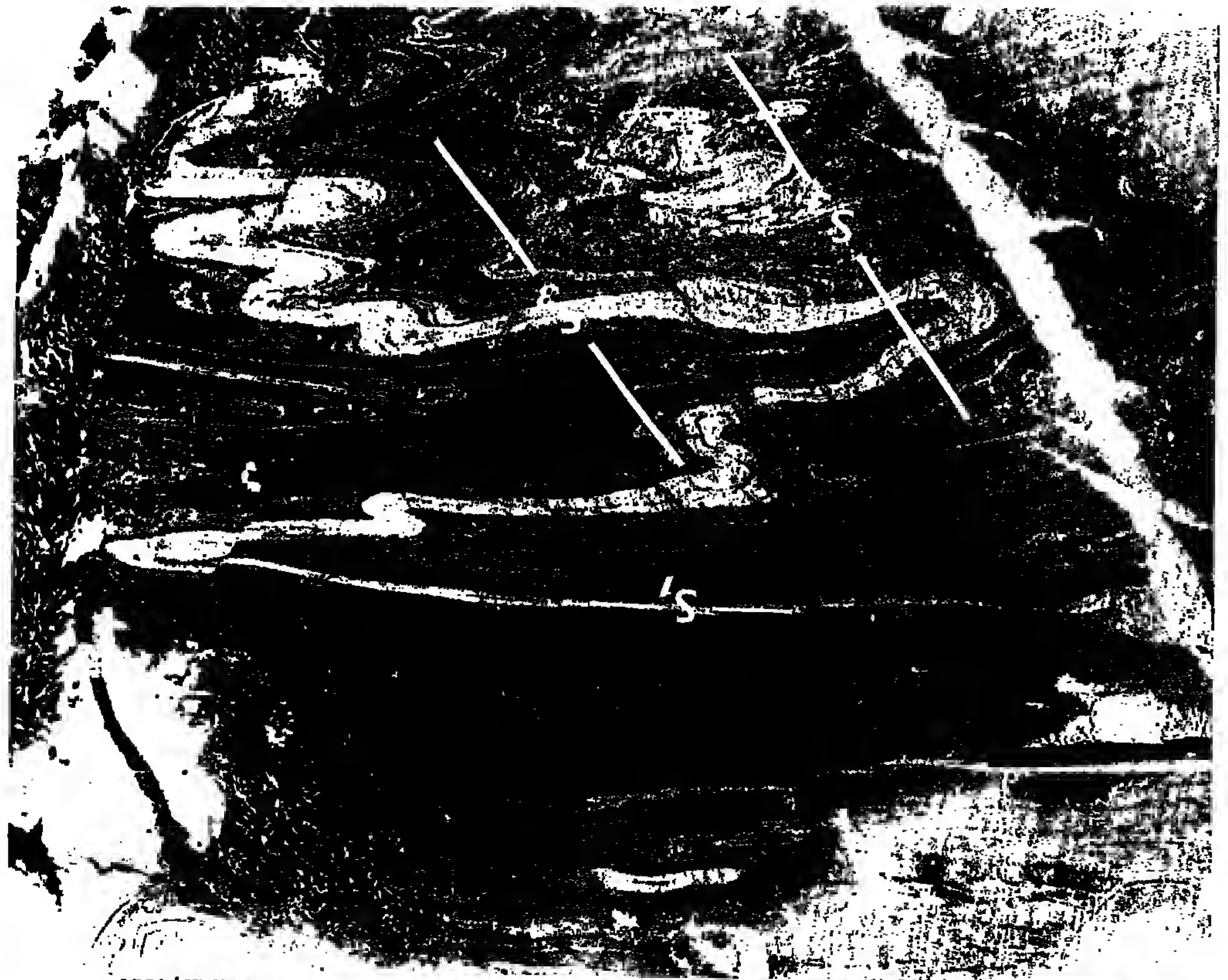
J. Geophys. Res., Red, Paper 1B1301

Geomagnetism and Aeronomy
Volume 21, Number 3

Brief Information

Chronicle

Bibliography



EOS
TRANSACTIONS, AMERICAN GEOPHYSICAL UNION
VOLUME 62 NUMBER 52 DECEMBER 29, 1981

Hydrology

3175 Soil moisture
MOISTURE AND HEAT TRANSPORT IN HYSTERETIC, INHOMOGENEOUS POROUS MEDIA: A MATRIC HEAD-BASED FORMULATION AND A NUMERICAL MODEL.
P. Christopher D. Milly, Ralph M. Parsons Laboratory, Massachusetts Institute of Technology, Cambridge, Massachusetts 02139

A general, physically-based formulation of water and energy transport in partially saturated soil must account for the coupling between the fields of matric potential (ψ) and temperature (T). The formulation by de Vries (1958) is converted to one that employs ψ and T as the dependent variables. This conversion facilitates a significant generalization of the theory to accommodate the omnipresent complications of hysteresis and inhomogeneity. The limitations of the assumptions of local thermodynamic equilibrium are discussed. A finite element solution algorithm for the one-dimensional equations is outlined and tested on a variety of problems. The computational results demonstrate the reliability of the numerical model. (Unsaturated zone, numerical analysis, porous media, heat flow).
Water Resour. Res., Paper 1V1684

3190 Instruments and techniques
A LOW-COST MULTICHANNEL RECORDING PIEZOMETER SYSTEM FOR WETLAND RESEARCH
H. Hemond (Massachusetts Institute of Technology, 48-419, Cambridge, Mass. 02139)

A low-cost system for the continuous recording of piezometric head is described. The system uses inexpensive earphones as sonar transducers, while using the narrow stem of the piezometers as an acoustic waveguide. The system overcomes several of the problems commonly encountered in tidal wetland investigations by providing rapid response, freedom from operator disturbance through peat compression, and essentially continuous automatic data recording in a directly machine-readable medium.
Water Resour. Res., Paper 1V1591

Meteorology

3730 Particles and Aerosols
STRATOSPHERIC AEROSOL AND CONDENSATION NUCLEI ENHANCEMENTS FOLLOWING THE ERUPTION OF ALAID IN APRIL 1981.
D. J. Hofmann (Department of Physics and Astronomy, University of Wyoming, Laramie, Wyoming, 82071), and J. M. Rosen.

A significant enhancement of the stratospheric aerosol and condensation nuclei levels was observed at Laramie, Wyoming beginning in May 1981, following the eruption of the volcano Alaid (50.8°N, 155.5°E) on April 28. Observations in mid-July suggest that in terms of effects on the stratosphere, the eruption was similar to that of Mt. St. Helens in May 1980. (Stratospheric aerosols, volcanic particles).
Geophys. Res. Lett., Paper 1L1635

3770 Particles and aerosols
THE TEMPERATURE DEPENDENCE OF THE FORMATION OF SULFATE AEROSOLS IN THE STRATOSPHERE
Glenn K. Yue and Adarsh Deepak [illegible] Atmospheric Optics and Remote Sensing (IFAORS), P. O. Box P, Hampton, Virginia [illegible]

Recent research has shown [illegible] particles in the stratosphere cannot be formed through homogeneous [illegible] nucleation process. However this conclusion is obtained by assuming the ambient temperature to be -58°C or -55°C, but in reality it is not unusual that in certain regions of the stratosphere temperature can be as low as -75°C or even lower. In order to assess the influence of temperature on the formation of sulfate aerosols in the stratosphere, and to explore the possibility of forming new particles through homogeneous nucleation processes at certain regions where the temperature is extremely low, the classical nucleation theory is applied to calculate the temperature dependence of the characteristics and nucleation rates of sulfate aerosols in the binary H_2SO_4 – H_2O vapor mixture. Our calculated results indicate that the number of new particles formed at a lower temperature is orders-of-magnitude larger than that at a higher temperature when the concentration of water and sulfuric acid vapors are kept constant. At stratospheric regions with low temperature there may exist large amounts of ultrafine particles which can hardly be detected by conventional methods.
J. Geophys. Res., Green, Paper 1C1649

3799 General Meteorology (Atmospheric Ozone)
ANALYSIS OF TOTAL OZONE DATA FOR THE DETECTION OF RECENT TRENDS AND THE EFFECTS OF NUCLEAR TESTING DURING THE 1960's
C. C. Reinsel (Department of Statistics, University of Wisconsin, Madison, Wisconsin, 53706)

Time series modeling of monthly total ozone data is considered for the detection of changes in ozone due to the possible effects of nuclear weapons testing in the early 1960's and more recent effects of the release of chlorofluoromethanes (CFMs). Based on ozone data from a network of ground-based Dobson recording stations over the period 1958-1979, the results of this analysis are consistent with a maximum decrease in total ozone in the northern hemisphere of approximately 1 to 4.5% due to nuclear testing effects in the early 1960's. More importantly, our findings show little evidence of any significant trend in global total ozone occurring in the 1970's, with the global change during 1970-1979 estimated as (.49 ± 1.35)%. (Total ozone, time series models, nuclear weapons testing effects, trends).
Geophys. Res. Lett., Paper 1L1627

Mineralogy, Petrology, and Crystal Chemistry

3640 Paragenesis, petrography and petrogenesis.
ALTERATION IN THE IRDP DRILLHOLE COMPARED WITH OTHER DRILLHOLES IN ICELAND.
H. Kristmannsdóttir (National Energy Authority, Grensásvegur 9, Reykjavík, Iceland).

In general the rock alteration in the IRDP drillhole at Reydarfjördur is very similar to alteration patterns observed in Icelandic geothermal areas and in low grade metamorphosed basalts in deep crustal sections elsewhere in Iceland. The drillhole starts in the laumontite zeolite zone extending down into the chlorite – epidote alteration zone. [illegible] more detail is obtained by the [illegible] drillcore than by study of drill cuttings sampled in previous drillholes in Iceland. A comparatively high [illegible] [illegible]

Tectonophysics

8150 Plate tectonics
KINEMATIC EVOLUTION OF THE NORTHERN COCOS PLATE
F. S. Schilt and D. E. Karig (Department of Geological Sciences, Cornell University, Ithaca, New York 14853)
H. Truchan (Lamont-Doherty Geological Observatory, Columbia University, Palisades, New York 10964)

As the East Pacific Rise approached and impinged upon the western margin of North America, the Farallon Plate began to break into multiple smaller plates, whose relative movements changed strongly from those before breakup. Movements of the northern Cocos plate, inferred from magnetic lineations, show rapidly changing rates and pole positions which may be characteristic of other small remnants of the Farallon plate. Finite difference poles and rates for Cocos-Pacific relative motion during the time intervals 2-5, 5-7, 7-10, and 10-14 my have been determined from the geometry of magnetic isochrons. Prior to about 2 my, the Cocos-Pacific pole was 10-20 degrees south of its present location, and angular rates were 2-4 times the present rate. From 10-7 my, we deduce a large degree of oblique convergence between the Cocos and North American plates, which may be an important constraint on the evolution of the structure of the continental margin of southwestern Mexico. The Tehuantepec Ridge originated as the ridge-ridge transform which generated the Clipperton fracture zone. Spreading rate estimates for the southern part of the Cocos plate suggest the possibility that the Tehuantepec Ridge was reactivated as a ridge-trench transform between the two Cocos plate fragments prior to about 7 my.
J. Geophys. Res., Red, Paper 1B1698

8150 Plate tectonics
THE CENOZOIC DENALI FAULT SYSTEM AND THE CRETACEOUS ACCRETIONARY DEVELOPMENT OF SOUTHERN ALASKA
Béla Csejtey, Jr. (U.S. Geological Survey, Menlo Park, California, 94025), D. P. Cox, R. C. Evarts, G. D. Stricker, and H. L. Foster

The juxtaposition of disparate geologic terranes in southern Alaska has been previously interpreted to be mainly the result of several hundred kilometers of right-lateral offset along the Denali fault system in Cenozoic time. Recent geologic investigations in the Healy quadrangle strongly suggest that Cenozoic horizontal displacements of such magnitude along the Denali fault system do not exist. In the Healy quadrangle, isograds and metamorphic facies boundaries of an early Late Cretaceous metamorphic belt trend across the Cenozoic McKinley strand of the Denali system without significant horizontal offsets.

The present geologic make-up of most of southern Alaska is primarily the result of the Talkeetna superterrane, consisting of the previously assembled Peninsular terrane and Wrangellia, colliding with and subsequently being thrust upon the Yukon-Tanana and Nixon Fork terranes of the ancient North American continent in about middle [illegible] time. The leading edge of the Tal[illegible] superterrane faces a wide, complexly de[illegible] that contains numerous northeastward-[illegible] terranes tectonically intermixed with [illegible] and Cretaceous flysch. The flysch is [illegible] to have been deposited mostly in the [illegible] and subsequently collapsed oceanic [illegible] the converging continental blocks. [illegible] Denali fault system developed [illegible] time across the already accreted [illegible] margin, in eastern Alaska along an [illegible] ceous suture. (Denali fault, tec[illegible] southern Alaska).
[illegible] Res., Red, Paper 1B1730